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ABSTRACT

The relationship between instruction and instructional design is explored. The aim of instruction is to assist the individual as learner. The Learner, the Content, the Media, the Teacher Function, and the Context within which learning is to occur interact during a period of time to form an instructional episode (the CMT paradigm). Considering all these interrelationships demonstrates the complexity of the learning process. Instructional design is the planning phase of the instructional creation process. Instructional design is both descriptive, in that it presents relationships, and prescriptive, in that it recommends organization of information based on known characteristics of the learner, the teacher, or the context. The practice of instructional design focuses on organization, strategies, and tactics that are supported by principles on which instructional improvement can be built. Teachers sometimes fear that a systems approach to instructional design will restrict creativity, but such an approach actually promotes creativity because of the dynamic attributes of the systems process. Three figures illustrate the discussion. (Contains 14 references.) (SLD)

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Visualizing the Complexities of Instruction: The CMT Paradigm

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by
Robert C. Branch

This is a brief essay about the relationship between instruction and instructional design. It is intended to promote discussion and build consensus among practicing instructional technologists as well as those new to the field of instructional design. The purpose is to illustrate instruction that involves multiple complex processes, and to explain how the practice of instructional design responds to those complexities of instruction. There is a need to understand the subtle differences between current definitions of learning, instruction and technology, and how their important relationships affect the achievement of students. These views are offered from a systems theory approach with instructional design as the perspective.

The aim of instruction is to assist the individual as learner. Achieving such an aim is complex because instruction occurs in an environment where each participating entity is within itself complex. The Learner, the Content, the Media, the Teacher Function, and the Context within which learning is to occur interact during a period of time to form an instructional episode (CMT paradigm). What are then formed are multiple two-way relationships between: the learner and the content, the learner and the media, the learner and the teacher, the learner and the context, the content and the media, the content and the teacher, the content and the context, the media and the teacher, the media and the context, and the teacher and some context, each occurring along some dimension of time (Figure1). Considering these interrelationships during the instructional episode causes the complexity of the learning process to increase exponentially. However, it is within the CMT paradigm that all instruction occurs (Figure 2).

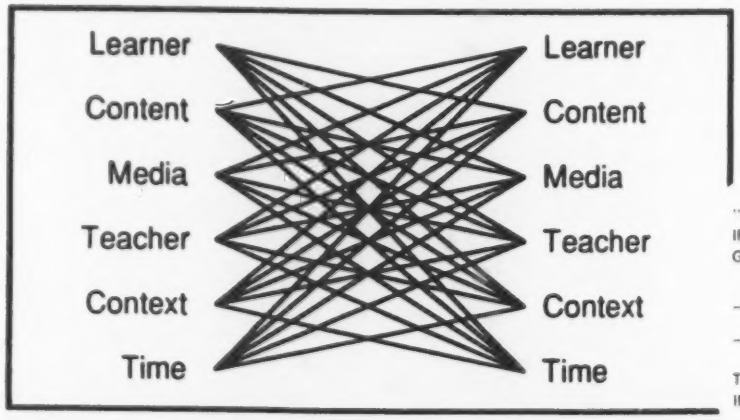

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Figure 1. The multiple two-way relationships which compose the instructional episode.

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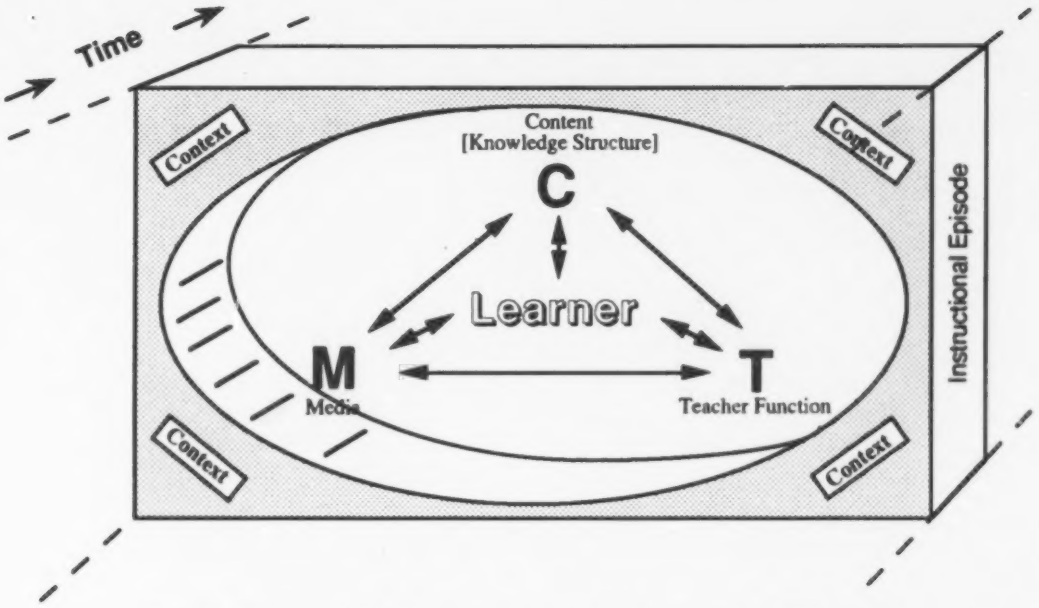


Figure 2. The complex environment in which learning occurs (CMT Paradigm).

The Learner

The learner is the focus of instruction. However, learners bring multiple expectations, goals and diverse values to the classroom that affect how they interact during the instructional episode and, ultimately, how they learn. It is important that instruction accounts for the individual differences within the learner audience. The more a teacher knows about the history, language, values, nonverbal behavior, and lifestyles of a group of people, the better she or he can incorporate such knowledge into instruction.

Education as a societal aim has the expectancy of certain outcomes from the educational system, such as production of a responsible, contributing citizen. Even in the business environment where the learner is often less the focus of instruction than are the business goals which have made the instruction necessary, the rules of corporate training and education need to be revised. "Line workers [have] to actually understand their work and their equipment" (Wiggenhorn, 1990, p.71).

Instruction should be treated as the vehicle that enables the learner to construct, or reconstruct, personal understandings, values, and beliefs. To understand the complexity of the learner is to understand the physical, emotional, social and mental development of people, as well as the effect of intelligence, cognitive styles, motivation, cultural norms, creativity, socioeconomic status and gender of the learning process.

The Content

Among the factors that influence the design and development of instruction is the structure of the content information. Content as a body of knowledge may be static or dynamic, but it is not a collection of unorganized facts existing in relative isolation one from the other (West, Fensham & Gerrad, 1985). Rather there are certain orderly structures inherent within subject matter knowledge (Reigeluth, Merrill & Bunderson, 1978; Wilson, 1985). Information is not discrete, isolated bits of knowledge, but, exists within an organized structure (Eylon & Reif, 1984).

Such structures reflect the interconnections or interrelationships among the facts, concepts, and principles that make up subject matter knowledge (Anderson, 1983). Representations of information and interrelationships among information can be called knowledge structures (Hannum, 1988).

When students learn subject matter knowledge, they learn both the specific content (the facts, concepts, and principles) and the structure that interrelates this content (Champagne, Gunstone, & Klopfer, 1985; Champagne, Klopfer, Desena & Squires, 1981; Geeslin & Shavelson, 1975; Naveh-Benjamin, McKeachie, Lin & Tucker, 1986; West & Pines, 1985) including cultural and personal norms perspective. The most prominent types of information relationships found in most knowledge structures are: attribute, categorical, classification, component parts, dimension, elaboration, goal, hierarchical, kinds, matrix, prerequisite, procedural, rule, skills, and type.

Because there is an orderliness or structure within subject matter knowledge, instructional technologists can design instructional episodes that adapt to the underlying structure. An understanding of the subject matter structure will assist instructional designers in organizing and sequencing instructional strategies. The same understanding of a specific knowledge structure should be communicated to learners to assist them in translating information from the knowledge structure of the content area to their own cognitive structure. For instructional episodes to achieve the desired effects, content information should be presented concurrently with its knowledge structure.

Recent evidence suggests another major facet of the complexity of content as a knowledge structure is centered around the issue of learner control. The learner should exercise some degree of control over the instructional process. Learner control can be described as the learner's judgements as to what should occur during instruction and why. Control by the learner is important for the understanding and assimilation of the content.

Media

Media is most often perceived as bright screens and fancy input/output devices, and is often perceived as synonymous with technology. The mere mention of media or technology evokes mental images of machines for which one is likely to immediately request assistance from the building's AV specialist. Some educators are comfortable with technological products and are adept at utilizing innovative technologies as educational media, and realize the concept of technology extends beyond the notion of hardware. The use of media in instruction should be determined based on the specific instructional objectives.

The role of instructional media is to provide communication cues that stimulate interest, motivate, illustrate ideas, provide concrete experiences, and direct attention. However, many communication cues found in media can be so internalized, that the effect of such cues on those with different backgrounds from one's own is often unrecognized. If the manner in which content information presented is biased towards a particular group, the risk is a reduced effectiveness in reaching all students. Instructional technologists should be taught strategies for ensuring cultural pluralism in instruction through the selection process of instructional media. Media which is related to the personal experiences of the learner will assist in building upon her or his prior knowledge as well as promote multi-culturalism, while media that is foreign to the experiences of a student or offensive to the values of a student tends to inhibit learning.

The Teacher Function

Good instruction is goal oriented with a specific purpose, therefore, the control over what is achieved is implied. Thus, instructional factors are within the realm of the teacher's manipulation.

Teachers and instructional designers arrange the content information around an organizing idea, determine appropriateness of available resources, and make judgements about the people involved.

The more a teacher knows about the history and lifestyles of the learner, the better a teacher can instruct. Generally, the teacher functions as decision maker regarding what will be taught. The teacher is often the primary information source unless the teacher functions solely as a facilitator of information. As facilitator, the teacher arranges the classroom interaction to motivate the learner and to direct the learner to different ways of knowing. Teachers guide learner actions, monitor progress, and manage the implementation of instruction. In most of the societies of the United States the teacher is also expected to function as disciplinarian, which ought not be the case.

The complexity of the teacher function increases when the teacher is considered as facilitator rather than the sole source of information. More cynical perceptions of the teacher are as a highly paid baby sitter, or a poorly trained police officer or social worker. Even the Utopian teacher role requires increasing individualization, group arrangements, societal norms, and information selection.

Context

Instruction is a form of education. Education, according to Frick (1991), is bound in time and space, and occurs in settings that may include persons other than teachers and students as well as places and things. It is the context which directly or indirectly influences the decisions that are made about instructional episodes. For example, decisions about state budgets tend to effect resource management to the extent that instructional strategies are compromised. Instruction does not occur in a vacuum and failing to be aware of that leads to a dangerous misunderstanding of instruction, as well as the meaning of instructional technology. The context within which instruction occurs is acknowledged as an entity that is comprised of conditions which instructional technologists are able to manipulate and those which are beyond the realm of manipulation.

Time

Time as a variable within the instructional episode is also complex because of its infinite, yet discrete, nature. Beginning and ending points, and precise units are arbitrarily set for the benefit of arranging nearly all human activities. Time is the controlling variable of most formal education environments. Further, time as the ever present variable, must be addressed due to its influence on every other variable within the instructional process.

While a comprehensive discussion of the concept of time is beyond the scope of this essay, it is important to note time's relevance to the instructional episode. The reality of instructional contexts is that formal educational environments are designed to promote learning, however, learning will have occurred in individuals prior to engaging in the activities set forth as part of instructional episodes and individuals will continue to learn after engaging in the activities of the instructional episode. Instruction may begin and end, but learning occurs all the time.

The issue here is relative to the interaction which occurs during the instructional episode. Learner achievement of prespecified outcomes depends on the chosen instructional strategy for a predetermined amount of time, such as during class period or field experience. An instructional strategy may vary in effectiveness depending on the allotted time. Moreover, the quality of an instructional activity is affected by the amount of time that can be devoted to it. Further, the abilities of individual learners directly influence the amount of time required to achieve specific learning outcomes. Understanding how time affects learner achievement is important because time is one of the few resources

that can be directly manipulated by the teacher and the learner.

Instructional Design

Instructional design is the planning phase of the instructional creation process. An instructional design is descriptive. It presents natural or existing interrelationships that constitute a content area. Instructional design is also prescriptive. It recommends organization, or reorganization, of information or sequence of events based on known learner characteristics, content as a knowledge structure, specific media and their attributes, salient features of the teacher function, the educational context, and the time available.

Instructional design is informed by general systems theory, learning theory, instructional theory and communications theory. General systems theory provides a framework from which the relationship between educational goal, performance objectives, instructional strategies and evaluation emerge. The feedback loop that is requisite to general systems theory allows the designer to respond to individual learner characteristics for specified content information delivered by a teacher utilizing appropriate media. Learning theory provides the background on how individuals acquire, store, retrieve, apply and synthesize information. Learning theory provides the descriptive aspects of instructional design while instructional theory determines the prescriptive strategies in order to meet the conditions described in learning theory. Communication theory describes what happens to a message sent from a source to a receiver. It is communication theory on which many of the principles guiding the practice of message design are based.

Instructional Design is a process which systematically addresses the aspects associated with the complexity of the variables within the CMT paradigm, by organizing their interactions in meaningful ways. Optimal sequences of learning activities that maximize available resources are arranged within the design phase. The product of the design phase is a detailed plan that defines the conditions of learning, describes relevant instructional relationships, and prescribes strategies and procedures for the development of instructional episodes. The resultant instructional design plan also identifies appropriate evaluation criteria for assessing potential strengths and weaknesses of the planned instructional episode. A generic model of the fundamental instructional design process is presented in Figure 3.

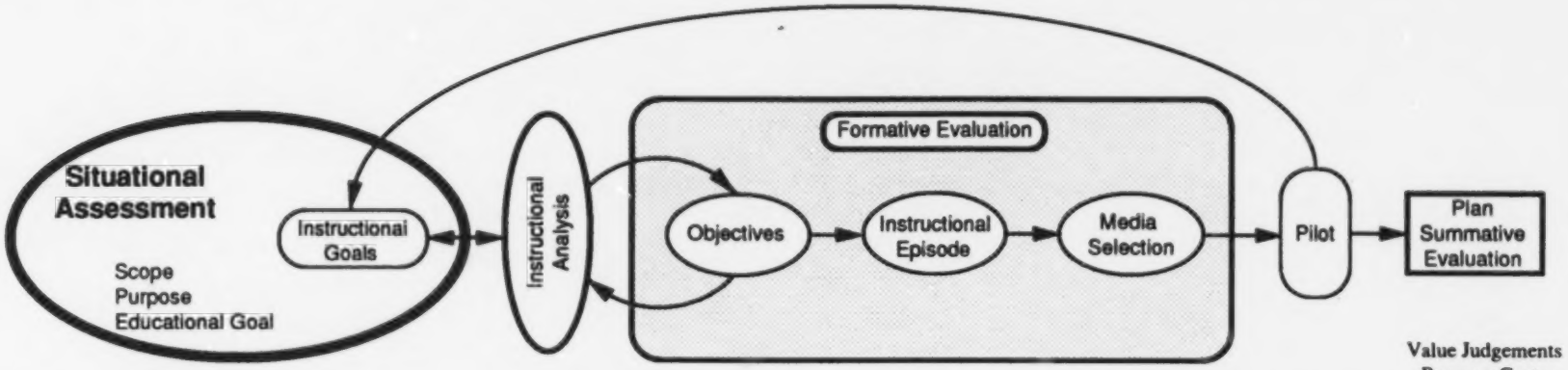
Common instructional design practices include:

1. Recommend alternative to instruction.
2. Translate conceptual models into prescription for practice.
3. Perform needs and learner analyses.
4. Determine scope, purpose and goals of instruction.
5. Select appropriate instructional strategies.
6. Generate and sequence objectives.
7. Construct assessment procedures.
8. Generate instructional analyses such as task, job, content, procedural and learning hierarchies.
9. Construct formative and summative evaluation plans.
10. Draft instructional blueprints.
11. Consult subject matter experts.

Conclusion

Creating or improving instruction is complex. The practice of instructional design focuses on the use of organization, strategies and tactics that are supported by principles upon which instructional improvements can be structured. Instructional strategies are the general points of view and line of action that one adopts in order to choose the instructional methods; or a set of decisions that result in a plan, methods, or series of activities aimed at obtaining a specific goal.

Instructional Design Process



Team concept
- Instructional Designer
- Instructional Developer
- Subject Matter Expert (SME)
- Management (Mgt)

Scope of performance assessment
Purpose of instruction
Educational goal

Instructional Goals:
Learning domain specific

Task
Content
Job
Learner
Skill
Intellectual
Procedural

Statements of:
- Conditions
- Performance
- Criteria

Matching test items

Formative Evaluation Plan

Sequence of events
- Pre-instructional
- Informational
- Learner participation
- Assessment
- Closure

Relevance
Availability
Production Cost

Goals as the Test
Actual Audience
Expert Review
Go/No go Decision

Objectives as the test
Based on:
- Learning theories
- Instructional theoies
- Data collection procedures
- Data analysis procedures
- Communication skills
- Management issues

Value Judgements
Program Costs
Management

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Figure 3. Generic model of the fundamental instructional design process.

Instructional strategies describe a general approach to instruction by prescribing how to organize, sequence or present information within the instructional environment.

Teachers often express a reluctance toward the use of instructional design models out of fear that the systems approach will restrict creativity (Branch, Darwazeh & El-Hindi, 1991). However, a systems approach to developing instruction promotes creativity because of the dynamic attributes of the systems process. Systematically designed instruction is a process which allows the teacher to establish clear relationships between instructional strategies and the predetermined learner outcomes.

As a field we are still at the stage where we find ourselves defining terms, terms which perhaps should already enjoy consensus. This essay is an attempt to create some degree of closure on important concepts and practices within the practice of instructional design. This should result in instructional designers devoting more attention to the issues impacting the field. In addition to being more focused, such consensus building should also increase the potential for instructional designers to successfully promote the practices within the domains of instructional design among the greater educational community.

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